Claims

1. (original) An optical phase detector, comprising:

a tunable optical source generating a first lightwave having a first polarization and a second lightwave having a second polarization and a delay relative to the first lightwave, the delay inducing a frequency offset between the first lightwave and the second lightwave as the tunable optical source is tuned over a designated wavelength range;

a target, receiving the first lightwave and the second lightwave, providing a third lightwave and a fourth lightwave in response to the first lightwave and the second lightwave;

a detector, intercepting a polarization component of the third lightwave and a polarization component of the fourth lightwave, and providing a detected signal at the frequency offset; and

a processor receiving the detected signal and extracting a phase difference, induced by the target, between the third lightwave and the fourth lightwave.

2. (original) The optical phase detector of claim 1 wherein extracting the phase difference between the third lightwave and the fourth lightwave includes phase comparing the detected signal to a frequency reference at the frequency offset.

3. (original) The optical phase detector of claim 2 wherein the frequency reference is provided by tapping the first lightwave and the second lightwave from the tunable optical source, passing the tapped first lightwave and tapped second lightwave

through a polarizer and detecting a resulting signal from the polarizer at the frequency offset between the tapped first lightwave and the tapped second lightwave.

4. (original) The optical phase detector of claim 3 wherein the tapped first lightwave and the tapped second lightwave are reflected at a reference target prior to the passing through the polarizer.

5. (original) The optical phase detector of claim 1 wherein the first lightwave has an s polarization and the second lightwave has an orthogonal p polarization.

6. (original) The optical phase detector of claim 4 wherein the phase difference is the phase of the p polarization component.

7. (original) The optical phase detector of claim 1 wherein the target includes an SPR transducer.

8. (original) The optical phase detector of claim 1 further comprising an imaging element interposed between the target and detector, the imaging element mapping physical locations of the target to physical locations of the detector.

9. (original) The optical phase detector of claim 8 wherein the target includes an array of SPR transducers.

10. (original) The optical phase detector of claim 1 wherein the tunable optical source includes a tunable laser coupled to a polarization maintaining coupler, an optical delay element coupled to a first output of the polarization maintaining coupler, a polarizing beam combiner coupled between the optical delay element and a second output of the polarization maintaining coupler, wherein the polarizing beam combiner is coupled to a collimator.

11. (original) The optical phase detector of claim 1 wherein the frequency offset is established by the relative delay and a tuning rate of the tunable optical source.

12. (original) An optical phase detection method, comprising:

tuning, over a designated wavelength range, a first lightwave having a first polarization and a second lightwave having a second polarization offset from the first polarization;

providing a frequency offset between the first lightwave and the second lightwave by imposing a relative delay between the first lightwave and the second lightwave;

directing the first lightwave and the second lightwave to a target providing a third lightwave and a fourth lightwave in response to the first lightwave and the second lightwave;

detecting a polarization component of the third lightwave and a polarization component of the fourth lightwave, to provide a detected signal at the frequency offset; and

extracting a phase difference, induced by the target, between the polarization component of the third lightwave and the polarization component of the fourth lightwave.

13. (original) The method of claim 12 wherein extracting the phase difference includes phase comparing the detected signal to a frequency reference at the frequency offset.

14. (original) The method of claim 12 wherein the first lightwave has an s polarization and the second lightwave has an orthogonal p polarization.

15. (original) The method of claim 12 wherein the frequency reference is derived from detecting a reference optical signal that passes through a polarizer, the reference optical signal including a tapping of the first lightwave and a tapping of the second lightwave.

16. (original) The method of claim 14 wherein the phase difference is the phase of the p polarization component.

17. (original) The method of claim 16 wherein the phase is recorded versus wavelength within the designated wavelength range.

18. (original) The method of claim 12 wherein the target includes a SPR transducer.

19. (original) The method of claim 13 further comprising mapping physical locations of the target to physical locations of a detector.

20. (original) The method of claim 19 wherein the target includes an array of SPR transducers.